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SRI International (Sarnoff)

(Sensei) Technical Report: Distribution A

Sensei: A Multi-Modal Framework for Assessing Stress Resiliency

(April 1-30, 2013)

From:
Ajay Divakaran, Technical Leader
Jeffrey Lubin, Senior Research Scientist
Joe Ferraro, Program Manager

Sensei (SRI #P21103)

Contract # N00014-12-C-0288

1 *Update: Technical Progress and Accomplishments for Period 15 (March 2013):*

Task 3.1: Capture Behavioral Stress Markers in Real-Time in Lab Environment with graded exposure to ICT's scenarios MAC 1-6

During this reporting period, we established reliable tracking between the GSR and facial region temperature tracking, as shown in Figure 1 below.

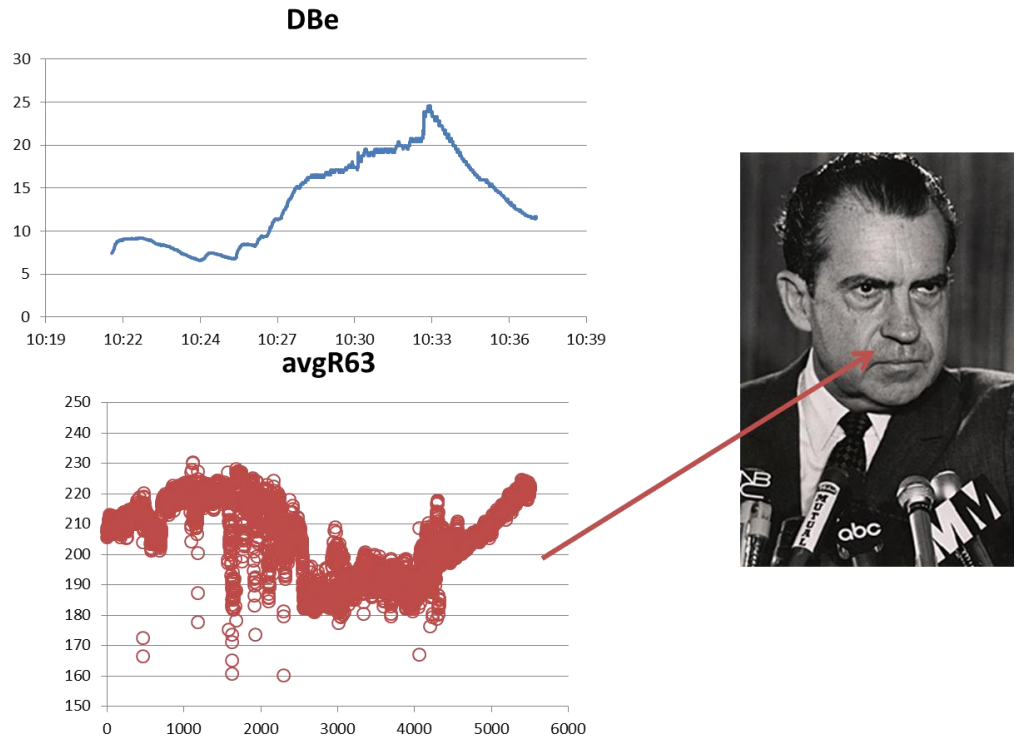

Figure 1. Comparison of fingertip skin conductance (upper plot) and upper lip temperature (lower plot), as determined from region averaging within a set of tracked

points on the face, the general location of which is indicated by the red arrow on the pictured face.

As these plots reveal, the upper lip is cooler when sweat-induced skin conductance goes up, a strong indicator that the evaporative cooling from a stress-induced sweat response on the upper lip is easily measurable and tracks well with the generally accepted stress measure ground truth of GSR.

Figure 2 below shows examples of thermal frames from the two relaxation phases (end image) and stressful task phase (center image). The relative darkening of the upper lip in the central image is the basis for the tracking revealed in Figure 1.

Figure 2. Facial feature tracking through experimental phases. Red dots indicate automatically tracked facial feature points.

During this period, we also collected more data using the two-phase consistent/inconsistent version of the experiment described in the previous report, needed so that we can rule out simple motion explanations for the upper lip effect, and so that we can obtain ground truth speech tones for a speech stress measure we are developing.

Interestingly, though, analysis of this data has revealed that subjects start to stress even during the consistent phase, probably because we still included the peripheral detection task in this phase, and the added burden of this task was stress-inducing. As a result, we have modified the paradigm again so that the first phase simply requires the naming of color words that appear on the screen. Data collection and analysis on this modified paradigm is currently under way.

For data collection, we are also about to collect some data in which the Stroop test is replaced by the simple viewing of videos that include disturbing scenes of different kinds. Although earlier in the project we shifted away from simple video viewing in favor of more active task-based stress that would provoke a stronger and more reliable stress response, the maturity of our current experimental paradigm – with pre- and post-task relaxation phases – suggests another look at the effects that may be observed with other stressors.

For data analysis, we have implemented a set of temporal filters that perform first derivative operations at different temporal scales, and then reports some running statistics on these filter ouputs as feature inputs to the classifier stage. We are currently implementing the classifier stage, based on the simple cosine similarity-based magnitude estimation approach reported earlier.

Task 3.2: Administer Scenarios and Verify Hypothesis **MAC 6-12**

Not yet at this stage.

Task 3.3: Program Management **MAC 1-12**

2. Issues:

- No current issues.

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